

CE

Consumer Electronics

Hall of Fame

2012





1919 S. Eads St., Arlington, VA 2202
CE.org

Honoring the 2012 Inductees Into the CE Hall of Fame

Tuesday, October 16, 2012
Grand Ballroom
The Westin St. Francis | San Francisco, CA

7-8 p.m.

Dinner Service

Menu

Salad

Boston Bib Wedge: Sundried Cranberries, Pecans, Goat Cheese, Blood Orange Vinaigrette

Entrée

*Filet of Angus Beef and Seared Scallops served with Roasted Corn Mashed Potatoes and
Caramelized Vidalia Onions with a Zinfandel Reduction*

8-9 p.m.

Presentation of the Inductees

Master of Cermonies

Gary Shapiro

President and CEO, Consumer Electronics Association (CEA)®

9-10 p.m.

Buffet of Assorted Desserts

Hall of Fame
2012



CE
Cable Electronic
Hall of Fame



Hall of Fame 2012



Welcome to the CE Hall of Fame awards dinner – one of our industry's best celebrations. Tonight we honor the elite leaders who have contributed their unique talents to grow our \$206 billion consumer electronics industry.

This annual dinner provides a forum to recognize individuals who have advanced consumer technology as well as to celebrate our rich history. Created in 2000, the CE Hall of Fame will grow to 182 members with 12 new honorees.

The new class of inductees includes engineers and inventors, business executives and the retailers that use innovative strategies to bring products to store shelves. For example, **Robert Briskman** was already a satellite communications legend, when he co-founded Satellite CD Radio – now Sirius XM – developing and implementing a major advancement in radio. **Willard Boyle** and his fellow Bell Labs researcher **George E. Smith** co-invented the CCD (charged-couple device), the first digital imaging chip, which transformed the world of photography. Zenith researcher **Richard Citta** invented a new interference-free transmission system called VSB (Vestigial Side Band) for digital television vastly improving TV reception. **Douglas Engelbart** invented the computer mouse and also earned the name, Father of Hypermedia.

All three corporate executives being inducted tonight founded start-ups that today are iconic industry brands. **Charlie Ergen**, an industry legend, invested in the nascent satellite TV business founding EchoStar and DISH, the pioneering satellite TV service. **In Hwoi Koo** followed a harmonious

management approach in South Korea growing LG into a global conglomerate. Another South Korean business leader, **Byung-chull Lee** founded Samsung Electronics in 1969 growing it into a worldwide consumer electronics giant.

In the retail arena, **Bjorn Dybdahl** founded one of the most innovative AV and custom install retail stores, Bjorn's Audio Video, in San Antonio. Indianapolis-based h.h.gregg founded by **Henry Harold Gregg** and his wife **Fansy** grew from one storefront into a nearly 200 store national chain. And **Larry Finley** founded the ITA (International Tape Association) in 1970 playing a pivotal role in the home recording and video business.

DETERMINING THE CLASS

How does the process work? A group of media and industry professionals met in New York on February 22, to judge the nominations that were submitted online by manufacturers, retailers and journalists. The judges used the democratic process of the majority of votes to determine the new class. We thank the following judges for participating in the CE Hall of Fame program:

Dave Arland	Steve Smith
Ivan Berger	Joanna Stern
Marge Costello	Tim Stevens
Paul Gluckman	John Taylor
Nancy Klosek	Stewart Wolpin
Myra Moore	Jim Barry
Maggie Reardon	Jack Wayman

SALUTE THE BEST

Do you know a visionary who should be in the CE Hall of Fame? To help shape the 2013 class, nominate the industry leader that you believe has had a substantial influence on the CE industry. Visit CE.org to submit a nomination form online or you can submit one tonight using the box in the lobby. Final selections will be judged by a group of CEA members, media and other industry professionals.

I also invite you to attend the International CES, the largest consumer technology tradeshow in the world and home to innovative entrepreneurs, inventors with bold ideas and astute business leaders. Come to CES on January 8-11, 2013 to see technology in action.



GARY SHAPIRO
CEA President and CEO



CINDY STEVENS
CEA Sr. Director, Publications

Congratulations

to the new inductees to the CE Hall of Fame. We thank you for your contribution to the advancement of the consumer electronics industry.

*Willard S. Boyle
Robert Briskman
Richard W. Citta
Bjorn Dybdahl*

*Douglas Carl Engelbart
Charles W. Ergen
Larry Finley
Henry Harold and Fansy Gregg*

*In Hwoi Koo
Byung-chull Lee
George Elwood Smith*



Thank You
to our Sponsor:

SPACE SYSTEMS
LORAL

DISTINGUISHED MEMBERS OF THE CE HALL OF FAME

2012

Briskman, Robert
Citta, Richard
Dybdahl, Bjorn
Engelbart, Douglas
Ergen, Charles
Finley, Larry
Gregg, Henry Harold and Fansy
Koo, In Hwoi
Lee, Byung-chull
Team: Willard Boyle and
George E. Smith

2011

Baer, Ralph
Bloomberg, Sandy
Harari, Dr. Eli
Hubbard, Stanley S.
Masuoka, Dr. Fujio
Metcalf, Dr. Robert
Shannon, Dr. Claude
Runco, Sam
Viterbi, Dr. Andrew
Team: Ivan Berger/
Lancelot Braithwaite

2010

Christopher, Dr. Lauren
Friedman, Rachelle and Joe
Kraft, Richard
McCann, Frank
Mondry, David and Eugene
Philips, Frederik
Sotoloff, Al
Upson, Cynthia
Weber, Dr. Larry
Team: Dr. Ivan Getting and
Dr. Bradford Parkinson

2009

Cohen, Maurice, Norman and Philip
Flaherty, Dr. Joseph

Jacobs, Dr. Irwin
Jobs, Steve
Neretin, Aaron
Shalam, John
Stinson, Walton
Terk, Neil
Wiley, Richard
Team: Karl Hassel and
Ralph Mathews

2008

Abt, David and Jewel
Clayton, Joe
Dumlavey, Dean
Fantel, Hans
Hartenstein, Eddy
Kutaragi, Ken
Lieberfarb, Warren
Sennheiser, Fritz
Sharp, Richard
Team: Martin Cooper and
Donald Linder

2007

Allen, Paul
Bose, Dr. Amar
Crutchfield Jr., William G.
Day, James Edward
McDonald, John
Sasson, Steven
Schulze, Richard
Weinberg, Art
Team: Dr. Karlheinz Brandenburg,
Dr. Heinz Gerhäuser and
Dr. Dieter Seitzer

2006

Doyle, Jack
Galvin, Robert
Heilmeier, George
Holonyak Jr., Dr. Nicholas

Ladd, Howard
Richard, Alfred J.
Roach, John
Team: Dr. Donald Bitzer, Dr. Gene Slottow
and Dr. Robert Willson
Team: Andrew Grove and
Gordon Moore

2005

Crane, Ken
Donahue, Joseph
Elias, Harry
Fezell, George
Gold, Saul
Levis, Art
Luskin, Jack
Matshushita, Masaharu
Winegard, John
Team: William Hewlett and
David Packard

2004

Blumlein, Alan Dower
Brief, Henry
Gerson, Robert E.
Kai, Ken
Kalov, Jerry
Klipsch, Paul
Ohga, Norio
Paik, Dr. Woo
Wozniak, Steven
Team: Richard Frenkiel
and Joel Engel

2003

Borchardt, Herbert
Feldman, Leonard
Immink, Kees A. Schouhammer
Kasuga, William
Kent, Atwater
Steinberg, Jules

Takayanagi, Kenjiro
Tushinsky, Joseph
Wurtzel, Alan

2002

Alexanderson, Ernst F.W.
Appel, Bernard
Baker, W.G.B.
Boss, William E.
Ekstract, Richard
Fisher, Walter
Gates, Raymond
Lear, William Powell
Polk, Sol
Sauter, Jack K.

2001

Berliner, Emil
Fleming, Sir John Ambrose
Gernsback, Hugo
Jensen, Peter Laurits
Muntz, Earl
Poulsen, Valdemar
Westinghouse, George

2000

Abrams, Benjamin
Adler, Robert
Armstrong, Edwin
Baird, John Logie
Balderston, William
Bardeen, John
Bell, Alexander Graham
Blay, Andre
Brattain, Walter
Braun, Karl Ferdinand
Bushnell, Nolan
Crosley Jr., Powel
DeForest, Lee
Dolby, Ray
DuMont, Allen

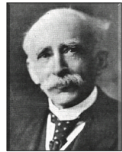
Edison, Thomas
Eilers, Carl
Farnsworth, Philo T.
Fessenden, Reginald Aubrey
Fisher, Avery
Freimann, Frank
Galvin, Paul
Ginsberg, Charles
Goldmark, Peter
Harman, Dr. Sidney
Hertz, Heinrich
Ibuka, Masaru
Johnson, Eldridge
Kilby, Jack
Kloss, Henry
Koss Sr., John
Lachenbruch, David
Lansing, James B.
Marantz, Saul
Marconi, Guglielmo
Matsushita, Konosuke
McDonald Jr., Cmdr. Eugene
Morita, Akio
Noyce, Robert
Poniatoff, Alexander M.
Roberts, Ed
Sarnoff, David
Scott, Hermon Hosmer
Shiraishi, Yuma
Shockley, William
Siragusa Sr., Ross
Takano, Shizuo
Tesla, Nikola
Wayman, Jack
Zworykin, Vladimir

CE HALL OF FAME GALLERY

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SIR JOHN AMBROSE
FLEMING



RICHARD FRANKEL



FRANK FREIMANN



JOE FRIEDMAN



RACHELLE FRIEDMAN



PAUL GALVIN



ROBERT W. GALVIN



RAYMOND GATES



DR. HEINZ GERHÄUSER



HUGO GERNSBACK



ROBERT E. GERSON



DR. IVAN GETTING



CHARLES GINSBERG



SAUL GOLD



PETER GOLDMARK



FANNY THROSMARTIN GREGG



HENRY HAROLD GREGG



ANDREW STEPHEN
GROVE



DR. ELI HARARI



DR. SIDNEY HARKAN



EDDY HARTENSTEIN



KARL ELMER HASSEL



DR. GEORGE
HEILMEYER



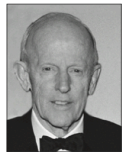
HEINRICH HERTZ



WILLIAM HEWLETT



DR. NICK HOLONYAK JR.



STANLEY S. HUBBARD



MASARU IWUKA



DR. KEES A.
SCHOUHAMER IMMINK



DR. IRWIN M. JACOBS



PETER LAURITIS
JENSEN



STEVE JOBS



ELDRIDGE JOHNSON



KEN KAI



JERRY KALOV



WILLIAM KASUGA



ATWATER KENT



JACK KILBY



PAUL KLIPSCH



HENRY KLOSS



IN HWOI KOO



JOHN KOSS SR.



RICHARD KRAFT



KEN KUTARAGI



DAVID LACHENBRUCH



HOWARD LADD



JAMES LANSING



WILLIAM POWELL LEAR



BYUNG-CHULL LEE



ART LEWIS



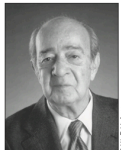
WARREN LIEBERFARB



DONALD LINDER



JACK LUSKIN



SAUL MARANTZ



GUGLIELMO MARCONI



DR. FUJIO MASUOKA



RALPH HOWARD
GROVES MATTHEWS



KENOSUKE
MATSUSHITA



MASAHARU
MATSUSHITA



DR. ROBERT METCALFE



FRANK MCCANN



COMMANDER EUGENE
MCDONALD JR.



JOHN MCDONALD



DAVID MONDRY

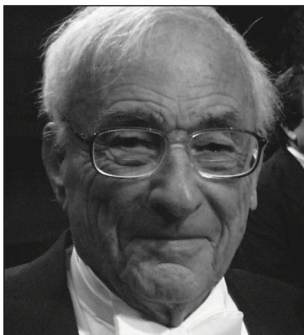


EUGENE MONDRY



2012 CE HALL OF FAME HONOREES

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Willard S. Boyle (1924 – 2011)

Co-inventor, CCD Imaging Chip

It's not as far from a small logging community in north Quebec, Canada, to Stockholm, Sweden as you might think. Willard Boyle made only a slight detour through Murray Hill, N.J., on his way to collecting a Nobel Prize with his fellow Bell Labs researcher George E. Smith for co-inventing the CCD (charged-couple device), the first digital imaging chip, which transformed the world of photography.

Boyle was born on Aug. 19, 1924, in Amherst, Nova Scotia, and was raised in the village of Wallace until his family moved to Chaudiere, Quebec. His father was the local physician, and Boyle was home schooled by his mother, who believed in the Socratic method of teaching. She asked him questions that required detailed explanations as answers. Boyle described her as a curious woman, and through her teaching, he developed a strong curiosity as well.

When he was 14, Boyle began his formal education at Lower Canada College in Montreal. He continued to pursue his scientific interests at McGill University, but in 1943, he joined

the Royal Canadian Navy and learned to land Spitfire fighter planes on aircraft carriers.

Boyle later returned to McGill, where he met his wife, Betty, whom he married in 1946. He completed his bachelor's, master's and finally his Ph.D. in physics in 1950. After earning his doctorate, he remained at McGill in Canada's Radiation Laboratory for a year, and then spent two years teaching physics at the Royal Military College of Canada in Kingston, Ontario.

In 1953, Boyle took a job at Bell Labs in Murray Hill, N.J. In 1962, he worked with Don Nelson to create the first continuously operating ruby laser, and, with David Thomas, was awarded a patent that helped lead to the development of the semiconductor injection laser, found in many electronic appliances. That same year, Boyle was named director of space science and exploratory studies at Bellcomm, a division of Bell Labs in Washington, D.C. While at Bellcomm, he worked on the Apollo program, and helped select lunar landing sites. Boyle returned to Bell Labs in 1964.

On September 8, 1969, Boyle entertained fellow researcher and CE Hall of Fame inductee George Smith in his office for one of their regular brainstorming sessions. That day's assignment: forming bubble memory using semiconductors.

After jotting some notes on the blackboard, Smith realized what they were devising could not only store data, but also could be an image sensor. The pair worked quickly, and within an hour had essentially created a digital imaging chip, the CCD. "[We] knew we had something special," Boyle said later. "We are the ones who started this profusion of little cameras all over the world."

The first model based on the team's ideas was constructed and demonstrated a few weeks later. The device was publically

announced early in 1970 and was quickly picked up by several companies.

A researcher at Kodak, CE Hall of Famer Steve Sasson, built the first working digital camera in 1975. CCDs would soon appear in any gadget that captured images or video, including cell phones, copiers, satellites, fax machines, and the cameras that roamed Mars and the ocean floor.

Boyle retired from Bell Labs in 1979 as executive director of the Communication Science Division, holding 18 patents. Retired at 55, he sailed his 33-foot boat for six leisurely weeks up the inland waterway from New Jersey, through the New York Harbor, up to Quebec and down the St. Lawrence to the house the Boyles had built in Wallace, Nova Scotia.

Over the years, Boyle has been honored many times including winning the Ballantine Medal of the Franklin Institute (1973), the Morris Lieberman Award of the IEEE (1974), the Progress Medal of the Photographic Society of America, the Breakthrough Award by the Device Research Conference of the IEEE, the Edwin H. Land Medal from the Optical Society of America (2001), the Charles Stark Draper Prize from the National Academy of Engineering (2006), and, with Smith in 2009, the Nobel Prize for Physics for the invention of the CCD. He was inducted into the Canadian Science & Engineering Hall of Fame in 2005.

Boyle lived in Wallace until his death on May 7, 2011.

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Robert Briskman (1932-)

**Satellite Radio Pioneer and Innovator;
Co-founder Sirius XM Radio**

Already a satellite communications legend, Robert Briskman should have been contemplating retirement as he approached his 60th birthday in 1990. Instead, Briskman co-founded Satellite CD Radio – now Sirius XM – developing and implementing the first major advancement in radio since Edwin Howard Armstrong invented FM radio, and revitalizing the radio industry.

Born in New York City on Oct. 15, 1932, Briskman earned his B.S. in engineering from Princeton University in 1954, and his Master's degree in electrical engineering from the University of Maryland in 1961. As chief of program support for NASA's Office of Tracking and Data Acquisition from 1959 to 1963, he invented the unified S-band microwave communications system still used by the International Space Station, receiving NASA's Apollo Achievement Award for his work.

After leaving NASA, Briskman worked for the Communications Satellite Corporation and then COMSAT General Corporation, holding a variety of positions. During his time at COMSAT,

Briskman was responsible for, or was involved in, a long list of satellite communication firsts, including satellite command and control for the launch of INTELSAT I (the first commercial communications satellite), the development and implementation of the INTELSAT global communications system, the COMSTAR satellite system, and the first TDMA system used for voice and data communications services for IBM. Briskman was also responsible for planning domestic communications services via satellites, including AT&T's satellite system.

He then served as senior vice president of engineering for Geostar from 1986 to 1990, where he was responsible for the development, design, implementation and operation of the company's Radio Determination Satellite Service (RDSS), which enabled positioning and message communications between mobile users and dispatch centers.

In 1990, former Geostar President Martin Rothblatt founded MARCOR, an incubator company, and asked Briskman to come aboard to assist in several of the proposed development ventures. One of these incubator companies, Satellite CD Radio, was established to discover if the idea of satellite radio was feasible. Briskman thought it was.

Briskman transformed his satellite radio theories into patented developments on satellite spatial and time diversity, to enable mobile users to receive satellite audio transmissions with almost no outages. He implemented the entire satellite radio technology infrastructure – the satellites, earth stations, terrestrial repeaters and consumer receivers – to make satellite radio practical. His efforts included a new digital broadcast technology called SDARS (Satellite Digital Audio Radio Service), which broadcasts digital audio from satellites in the 2332 MHz band.

Briskman designed and directed the construction of three of the then most powerful commercial broadcast satellites, each

producing two megawatts of radiated power, and launched them into a "figure 8" geosynchronous orbit over the Americas in 2000. The unique elliptical orbit that Briskman devised achieves the highest possible elevation angle of the satellites to the three-channel mobile receivers he designed. As a result, Sirius XM radios can almost always capture the signal, even in urban centers.

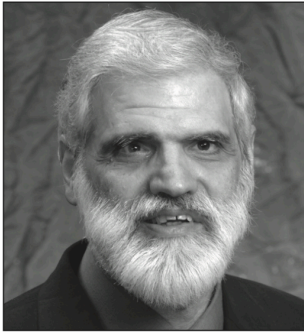
Briskman designed and built the earth stations and satellite control facility technologies to complete the Sirius system. On the business side, he helped procure the radio frequency allocations from the FCC, finalized in 1993, and aided CD Radio CEO, David Margolese in raising the needed \$1.4 billion to launch the service. In 1999, the company was renamed Sirius Satellite Radio.

Sirius started broadcasting on July 1, 2002. Briskman's technology was then licensed to competitor XM, which merged with Sirius in 2008. Today, Sirius XM subscribers can receive more than 160 audio channels, including 65 commercial-free music channels and 95 voice channels featuring sports, news, entertainment, traffic, commentary, weather and other topics.

Satellite radio now has more than 23 million U.S. subscribers and another two million in Canada, with more than 50 million estimated listeners.

After retiring from the board of directors and other executive positions, Briskman assumed the title of technical executive to concentrate on finishing and improving the technical implementation of the Sirius XM system. He has successfully launched a record 31 consecutive satellites; a 32nd is due to launch in 2013.

Briskman has been honored by a multitude of satellite, science and engineering organizations including the AIAA (The American Institute of Aeronautics and Astronautics), the Washington Academy of Sciences, the IEEE, the SSPI (Society of Satellite Professionals International) and the Space Foundation.



Richard W. Citta (1944 -)

Digital Television Pioneer

For 70-plus years, there was only one method used to broadcast over-the-air television, an analog method prone to interference from nearly anything and everything inside and out, including simply walking by a TV antenna. Persnickety TV reception has all but disappeared thanks to an interference-free digital transmission system called VSB (Vestigial Side Band) invented by former Zenith researcher Richard W. Citta. But instead of toiling over schematics, test equipment and equations in a lab, Citta discovered the solutions to the digital broadcasting problem while lying in a hospital bed.

Born in 1944, like many teens, Citta and his friends were ham radio operators, building their sets from kits sold at local electronics stores. Citta tinkered with cars and fixed all the teachers' TVs. He worked on electronics sets others had bought but were unable to complete. He earned his B.S. in electrical engineering from the Illinois Institute of Technology in 1968 and his Master's in the same subject from the University of Washington in 1971. While still in college, he worked at Zenith during the summer. His first project was more than doubling the functions of Zenith's breakthrough ultrasonic TV remote

control, invented by the company's Dr. Robert Adler, a charter CE Hall of Fame inductee. By adding a second transistor, Citta managed to expand the functions from four to 10 and maintained performance when battery power dwindled.

Citta headed Zenith's advanced development for cable technologies, working on a new cable scrambling and encryption system. In 1987, when the FCC announced the high-definition TV initiative and the need for a transmission system confined within existing broadcast channel spectrum, Citta suggested the unique cable modulation system he was working on could be a solution.

In the spring of 1988, Citta was perched precariously atop a ladder while painting his house. The ladder gave way and Citta fell, crushing his left ankle. While lying immobile in the hospital, Citta pondered the HDTV transmission problem – and experienced a “Eureka!” moment. He drew diagrams for what would become the new VSB digital TV transmission scheme and presented his concept to Zenith higher-ups when back on the job.

Citta theorized he could use a method similar to what the company was developing for transmitting digital signals over cable lines. VSB modulation employs unique technology to prevent interference into existing NTSC (analog) broadcast signals and special techniques to prevent interference. The signal contains a unique pilot signal to aid in reception under adverse receiving conditions resulting from white noise, impulse noise and multipath impairments.

The breakthrough allowed the use of the previously unusable or “taboo” buffer channels in the VHF and UHF television broadcast spectrum, a key to the simulcast transition plan to digital television. VSB was first proposed as an HDTV transmission method in Zenith's 1988 proposal to the FCC's Advisory Committee on Advanced Television Service (ACATS), chaired by former FCC Chairman Richard E. Wiley, another CE

Hall of Fame inductee. Based on the success of these demos, Citta and the Zenith team developed the so-called 8-VSB transmission system, employed by the HDTV Grand Alliance, which was formed in May 1993.

Citta led exhaustive testing under both laboratory and real-world conditions. The Grand Alliance standard was recommended by Wiley's ACATS in November 1995 after a battery of successful transmission field tests in Charlotte, N.C. In December 1996, VSB was officially adopted by the FCC as the centerpiece of the nation's new digital television broadcast standard.

Citta led many of the technological innovation efforts that facilitated the end of analog TV broadcasting and its replacement by the digital VSB technology. These efforts laid the foundation for the FCC's simulcast rules during the transition from analog to all-digital broadcasting between 1996 and 2009.

Today, more than 1,800 U.S. television broadcasters are broadcasting digitally using VSB. Hundreds of millions of digital TV sets have been sold in the U.S. alone, that contain VSB demodulators.

After retiring from Zenith in 2000, Citta was named chief scientist for LINX Electronics, where he designed digital TV receivers. He spent three years as chief scientist for chip maker Micronas, developing custom integrated circuits and chips for use in HDTVs, and two years as a consultant with Thomson before founding his own consulting firm, the R. Citta Group, which develops concepts for enhancing the mobile ATSC DTV ecosystem.

Citta has been awarded more than 200 patents with many still pending. He is a charter member of the Academy of Digital Television Pioneers among numerous other honors.



Bjorn Dybdahl (1943 -)
Founder, Bjorn's Audio Video

Although he never learned to play an instrument, Bjorn Dybdahl's love of music led him to found one of the country's most innovative and successful AV and custom install retailers, Bjorn's Audio Video, in northern San Antonio, insisting, "We sell entertainment and fun, not equipment."

Dybdahl was born June 4, 1943, in Oslo, Norway. When he was six, his parents immigrated to the U.S., settling in Minneapolis. The young Dybdahl soon developed a passion for classical music; his first record was what he thought was the theme for "The Lone Ranger" – the William Tell Overture. From there, Dybdahl discovered composers such as Beethoven, Brahms and Tchaikovsky, literally wearing out records, which he played on a portable record player in his room. Like many kids in the 1950s, his first job was as a paperboy. He then was hired as a stock boy at Dayton's department store. These jobs made him realize how much he enjoyed dealing with customers.

Without a specific career goal after graduating from high school, Dybdahl joined the Air Force in December 1961.

Five months later, he married his high school sweetheart Sharon (Shari). Stationed in San Antonio, Dybdahl soon realized he didn't want to make the Air Force a career and started college at St. Mary's University in San Antonio while still serving. He graduated in 1971 with a degree in political science.

In 1967, a year before leaving the Air Force, Dybdahl started working for Bill Case Sound, a small audio store in San Antonio, to discover if he could turn his hi-fi avocation into a profession. At first, Dybdahl thought he would move back to Minneapolis after leaving the service and open a hi-fi shop.

But upon his discharge, Dybdahl realized he had no money, a wife, a daughter, another child on the way, and that he hated snow. He continued to work for Case until the summer of 1975.

At loose ends, Dybdahl received encouragement from several old Case customers. One previous customer called Dybdahl and asked how much he needed to open his own hi-fi store. Dybdahl got a loan of \$15,000 with no strings attached and, together with an SBA loan, was able to open a 1,000-square-foot store on October 1, 1975. He and a bookkeeper were the store's lone employees. Less than a year later, Dybdahl hired his second employee and a custom installer, although at the time, neither Dybdahl nor anyone else knew what a "custom installer" was.

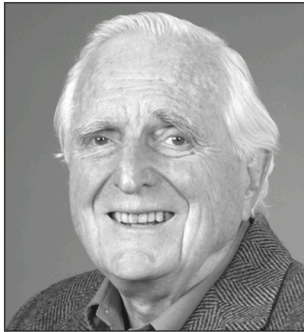
Founded the year Sony introduced the Betamax and on the eve of the home video and home theater revolutions, Bjorn's began concentrating on "systems," before "home theater" was even a term, helping to introduce the latest home theater innovations to the San Antonio area. In 1976, Bjorn's introduced the first two-piece video projector; two years later, Dybdahl integrated a multi-channel Audio Pulse system with a large screen projector and a laserdisc player to create an early surround sound demo.

Bjorn's helped introduce the CD, and was one of the first to demo HDTV, home THX and direct broadcast satellite (DBS)

TV. Bjorn's gave the first public demos of Dolby AC-3 (aka Dolby Digital), dual-layer DVD, HDTV and Pioneer's first plasma TV. In 2006, Bjorn's presented the first U.S. consumer demos of Blu-ray and HD-DVD and in 2007, one of the first 3DTV debuts with Texas Instruments and Mitsubishi. Dybdahl appeared as an HDTV spokesperson for Time Warner Cable TV ads, and has produced numerous broadcasts to educate consumers about HDTV.

Dybdahl was an early member of PARA and a founding member of CEDIA. Audio Video International magazine has named Bjorn's an Audio/Video Retailer of the Year every year since 1987, and in 2000, Frost & Sullivan presented Bjorn's with its Market Engineering Award for customer service leadership.

Bjorn's continues to grow, having expanded four times. Its current location, a 25,000 square foot building, is accompanied by a 25,000 square foot warehouse, an installation group staffed by a dozen installers and a service department. "Yes, Bjorn's still fixes stuff," Dybdahl says. He continues to prowl the show floor, helping customers on a regular basis.



Douglas Carl “Doug” Engelbart (1925 -)

Inventor of the Computer Mouse; Father of Hypermedia

Douglas Engelbart envisioned how to create, access and share ideas and information using computers, as well as how people could interact with one another and work together more effectively in a connected world.

To bring this holistic system into existence, Engelbart created windowed screen design, the user interface, hypermedia, collaborative computing, multimedia, knowledge management and the mouse. His seminal work beginning in the early 1960s led to the creation of the graphical user interfaces (GUIs) now used on all computing devices, and laid the foundation for how and why most of us use computers and the Internet today.

Engelbart was born in Portland, Ore., on Jan. 30, 1925, to Carl Louis Engelbart and Gladys Charlotte Amelia Munson Engelbart. He attended Oregon State College (renamed Oregon State University) for a year, but was drafted, serving two years in the Navy. In 1948, he returned to Oregon State and earned a B.S. in electrical engineering. His first job out of college was

at the Ames Research Center, run by the National Advisory Committee for Aeronautics (NACA), the precursor to NASA.

In 1951, Engelbart got engaged to his wife, Ballard and returned to school, earning a Master's (1953) and a Ph.D. (1955) from the University of California at Berkeley in electrical engineering with a specialty in computers. He stayed on at Berkeley as an acting assistant professor, and in 1957, moved on to the Stanford Research Institute (SRI, now SRI International).

At SRI, Engelbart began to develop tools to augment how people and organizations collect, use and share information. One of these technologies was hypermedia, the linking of one piece of data to another, developed independently but simultaneously in 1964 with east coast-based Ted Nelson, who coined the terms “hypertext” and “hypermedia.”

For Engelbart, hypermedia was part of a larger integrated system. The foundation of the first hypermedia groupware system was dubbed NLS (oN-Line System). To help navigate NLS, Engelbart experimented with “screen selection” devices – pointers to navigate information presented on a computer screen including a light pen, a foot pedal, a knee apparatus and even a helmet-mounted device.

In 1961, Engelbart envisioned a pointing device that would traverse a desktop on two small wheels, one turning horizontally, the other vertically, each transmitting rotation coordinates to determine the location of a floating on-screen pointer. Two years later, lead engineer Bill English built one from Engelbart's sketches. Encased in a carved out wooden block with perpendicular wheels mounted in the underbelly, it had only one button – that was all there was room for. Someone lost to history started calling it “the mouse.”

Engelbart and his crew experimented with additional buttons, working up to five, before settling on three by 1968. SRI patented the mouse, naming Engelbart as its inventor.

At the Joint Computer Conference, a semi-annual meeting of major computing societies in San Francisco on Dec. 9, 1968, Engelbart conducted what has become known as “The Mother of All Demos,” a seminal event in the history of contemporary computing. In front of 1,000 computer professionals, Engelbart and his geographically remote colleagues conducted the first public demonstration of the mouse, hypermedia and hyperlinking, display editing, windows, cross-file editing, idea/outline processing, collaborative groupware, and on-screen video teleconferencing – all brand new concepts and technologies at the time.

Engelbart also was involved in the development of the Defense Department's Advanced Research Projects Agency (ARPA) ARPANET. On Oct. 29, 1969, Engelbart's lab was at the receiving end of the first message transmitted over ARPANET, which would eventually lead to the inception of the Internet.

In the early 1970s, several of Engelbart's ARC engineers landed at Xerox's new Palo Alto Research Center (PARC), incorporating some of Engelbart's more tangible ideas into the Xerox Alto, the first personal computer with a GUI and a mouse. The GUI/mouse system developed for the Xerox Alto was later adapted for Apple and Windows operating systems.

In 1989, Engelbart, and his daughter, Christina, formed the non-profit Bootstrap Institute, which was renamed the Doug Engelbart Institute in 2008, and is now run by Christina.

Engelbart has been awarded 20 patents and is the recipient of multiple awards and honors including the *PC Magazine* Lifetime Achievement Award (1987), the IEEE Computer Pioneer Award (1993), the Lemelson-MIT Prize (1997), induction into the Computer Hall of Fame and the U.S. National Medal of Technology, presented by President Bill Clinton (2000) and the Certificate of Special Congressional Recognition (2005).



Charles W. "Charlie" Ergen

(1953 -)

Co-founder DISH/EchoStar

Charlie Ergen is a bona fide gambler. In between jobs, he and a friend literally tried their hands in Las Vegas dealing blackjack and playing poker. But his biggest gamble was investing in the nascent satellite TV business, a bet that resulted in the founding of EchoStar and DISH, the pioneering satellite TV service.

Born March 1, 1953, Ergen's interest in technology may well have been influenced by his birthplace – Oak Ridge, Tenn., a sleepy village built into a factory town by the federal government during World War II to produce plutonium for the atomic bomb – and by his father, William, an Oak Ridge National Laboratory scientist. Ergen's interest in business may have come from his mother, Viola, who was business manager of the Children's Museum of Oak Ridge.

Ergen earned a bachelor's degree in general business and accounting from the University of Tennessee, and an M.B.A. from Wake Forest University. His first job out of school was as a CPA and financial analyst for Frito-Lay, from 1976-1978.

By 1980, Ergen and a friend, Jim DeFranco, drifted to Las Vegas to make their way as professional gamblers. But they were evicted from a Las Vegas casino for card counting. Once again at loose ends, DeFranco spotted a truck carrying a large C-band satellite dish and a business idea was hatched. DeFranco, Ergen and Ergen's wife, Cantey – known as Candy – started EchoSphere, a door-to-door C-band satellite TV sales and installation business.

The trio pooled \$60,000 in savings, bought two satellite dishes and headed to Colorado – they figured folks got poor over-the-air reception in the mountainous state. Ergen and DeFranco would drive to rural towns to deliver the C-band dishes for up to \$15,000 plus \$600 for installation, a dollar per mile more past 50 miles outside of Denver – unless the pair was allowed to rest for the night at the customer's home.

By 1985, EchoSphere had earned more than \$100 million in revenue. But Ergen believed the only real path to growth was to launch his own satellite. In 1987, Ergen and DeFranco applied to the Federal Communications Commission (FCC) for a direct broadcast satellite (DBS) license, which was approved in 1992.

Ergen contracted with China to launch his bird, and on Dec. 28, 1995, a rocket bearing EchoStar I was launched successfully from Xichang, China. DISH, with a newly-built satellite uplink center in Cheyenne, Wyo., began broadcasting in March the following year. A second satellite was launched and a second customer service center was opened later that year.

Within four months, DISH reached the 100,000 subscriber milestone and the company celebrated its millionth customer following the launch of EchoStar III on Oct. 5, 1997, from Cape Canaveral, Fla.

Two years later, EchoStar bought the broadcasting assets of a satellite broadcasting joint-venture between News Corporation's

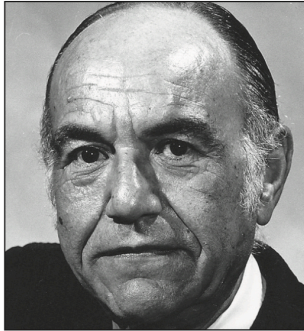
ASkyB and MCI Worldcom, more than doubling DISH's continental U.S. broadcasting capacity. In 1999, DISH unveiled the DISH 500, the world's first satellite TV system, with more than 500 channels. In 2000, DISH released its first HDTV receiver. Over a six-month period straddling 1999-2000, its stock rose from \$5 to \$79.

Ergen also fought for the satellite broadcast industry by helping secure passage of the Satellite Home Viewer Improvement Act in 1999, which allowed satellite broadcasters to carry local stations.

By August 2003, DISH had launched EchoStar IX from a floating platform at the equator, the first Ka satellite; in all, DISH has launched a dozen satellites. By 2004, DISH became the first satellite TV service to offer local channels to all 50 states, the first to develop a UHF remote control and the first to sell a satellite receiver for less than \$200. In 2012, DISH unveiled the Hopper, a whole-home HD DVR system that can record six channels simultaneously and allows customers to automatically skip commercials on most PrimeTime Anytime DISH programming.

In May 2011, Ergen stepped down from his role as president and CEO to become chairman of the board. When not tending to DISH business, Ergen climbs mountains. A member of the Colorado Mountain Club, Ergen has climbed each of the state's 14,000-foot peaks, as well as Mount Kilimanjaro in Tanzania, Mount Aconcagua in Argentina and the Mount Everest base camp in Nepal.

His biggest achievement, however, is his 30-year-plus marriage to his wife, Candy, and their five children.



Larry Finley (1913 - 2000)
Founder, ITA (International Tape Association)

Audio cassettes were still a curiosity in the late 1960s, and videotape was used only in television studios. But a Los Angeles restaurateur, radio and TV personality, music recording pioneer and entrepreneur named Larry Finley saw the future of both audio and video tape, founding the ITA (International Tape Association) in 1970. ITA and its later incarnations – IRMA (International Recording Media Association) and, today, the CDSA (Content Delivery & Security Association) – played pivotal roles in establishing the home recording and video business.

Born May 4, 1913, in Syracuse, N.Y., Finley and his cousins built crystal radio sets like many boys in the early 1920s – except Finley sold them to families who wanted to hear radio broadcasts in their homes. His youngest cousin, Rod Serling, became fascinated by these radios and would go on to write radio plays and create *The Twilight Zone*.

Finley began his long and eclectic professional career at 18 as manager of a local nightclub, the Cafe DeWitt. Enticed by the

glamour of Hollywood, he moved to Los Angeles and opened Finley's Credit Jewelers in Burbank, adding stores in Hollywood and throughout the LA area. To promote his burgeoning business, Finley staged street dances and concerts featuring famous musicians.

In 1944, Finley opened the Casino Gardens Ballroom in San Diego, partnering with Tommy and Jimmy Dorsey. After the ballroom closed, Finley moved back to Los Angeles in the early 1950s opened up Larry Finley's restaurant on Sunset Boulevard, next door to the world famous Mocambo. On the heels of his MC'ing experience at Casino Gardens, Finley decided to initiate a radio show on KFWB, *The Larry Finley Show*, broadcast nightly from his restaurant. He recorded his shows on the latest audio tape format, and syndicated them around the country.

In 1954, Finley produced an early 24-hour TV telethon, raising more than \$1.5 million for the City of Hope National Medical Center in Duarte, Calif., for which he received the Los Angeles City of Hope Torchbearer Award.

Finley also became an early television pioneer; Finley Productions Inc. was the first west coast independent TV production company. He hosted a series of music-based local TV shows in the late 1950s on KTLA-TV and KABC-TV. Finley kinescoped and sent these shows by the Armed Forces Network to troops in Korea.

On radio and TV, Finley interviewed the biggest entertainers of the day and introduced new stars, including Peggy Lee, Ella Fitzgerald, Lou Rawls, Johnny Ray, Les Paul and Mary Ford. He also became friendly with entertainment industry heavyweights such as Howard Hughes, Louella Parsons, Lucille Ball, Desi Arnez and Walter Winchell.

In 1960, Finley moved to New York City and became president of Tops Records, and later, director of sales at MGM Records.

Recognizing the potential of 8-track tape, Finley founded the International Tape Cartridge Corporation (ITCC) in 1965. Finley acquired audio tape rights from the leading 27 record labels, making ITCC the largest provider of entertainment on 8-track tape. During that year, Finley held the exclusive rights and licenses for all music on 8-track tape. Philips licensed much of Finley's catalog for use on its new compact audio cassette format.

In late 1969, Finley was approached to start an association for this new, quickly developing cassette tape industry. ITA was formed in 1970 with eight member companies, including Panasonic, Philips and TDK.

To establish quality and ethics standards within the tape industry, Finley contacted 3M, the major supplier of blank tape at the time, and convinced them to adhere to a labeling standard. Finley also fought successfully to keep commercial and consumer analog tape format decisions out of government hands.

In 1979, Finley left ITA and formed Larry Finley Associates, which acquired programming for home video. He also became a proponent of the VHS format, and by so doing, became known as the Father of Video Tape. He encouraged JVC to license its VHS technology to duplicators and loaders, which allowed third-party vendors to produce and distribute video tape titles around the world – the basis of the entire packaged home video business. In 1984, he was inducted into the Video Hall of Fame.

Finley passed away on April 3, 2000, at his home in Long Island, N.Y. "It takes a great man to create a business, but it takes a visionary to create an entire industry," said a former associate. "Larry Finley was such a visionary."



Henry Harold “Hine” Gregg
(1911 – 1974)

Fanny Throgmartin Gregg
(1917 – 2004)

Founders, h.h. gregg

A man bought a TV from a new electronics and appliance store. Over a holiday weekend, the TV stopped working. The customer called the store's owner – at home. The owner told the customer to meet him at the store with the broken TV in 20 minutes. The owner unlocked the store and got the customer a new TV.

That story sums up the successful five decade-plus customer-focused “Our progress will come through satisfying the customer” philosophy of Indianapolis-based h.h. gregg and its founders Henry Harold Gregg, better known as “Hine” and his wife, Fanny. It is this philosophy that has allowed h.h. gregg to grow from one small storefront into a nearly 200-store national chain generating more than \$2 billion in sales.

Hine, a Navy veteran of World War II, was managing the Biddle Screw Products appliance store in Sheridan, a small town 25 miles northwest of Indianapolis. Fanny was the home service

director for the Gibson Company in Indianapolis and traveled around Indiana and Illinois teaching retailers to sell and operate appliances and giving customer demonstrations. She would also go to homes and instruct owners how to operate new-fangled automatic clothes washers. One of her Gibson training stops in 1949 was at Biddle, where she met Hine.

Hine moved to Indianapolis to take a job as an appliance salesman for A.C. Zickler at 4930 North Keystone Avenue and later became store manager. Two years after they married, Hine and Fanny used \$3,000 they had saved and purchased A.C. Zickler's 800-square-foot showroom, opening on April 15, 1955. The Gregg's sold Admiral, RCA, Spartan and Whirlpool washing machines, clothes dryers, refrigerators and outdoor grills out front while Zickler continued to run his plumbing business in the rear. They soon also started selling “brown goods” including black-and-white TVs.

A newspaper ad six months later exclaimed “APPLIANCES at ZICKLER'S,” with “h.h. gregg, Proprietor” listed at the bottom. Hine served as the sales force while Fanny was in charge of the office. More importantly, that ad also asserted “We Will Be Here Tomorrow to Service the Appliance You Buy Today.”

The Gregg's used off-duty firemen as delivery men, or Hine and the customer would load the goods into the store's old red pickup truck and make the delivery.

Gregg's started to really grow once they started selling color TVs. On January 1, 1960, the couple invited guests to their home to watch the football bowl games on their RCA color TV. After three years of these personal demos, the couple added a “color room” to their new 5,200-square-foot headquarters, three blocks from the former Zickler store and began hosting their annual New Year's Day football festivities there.

The business' growth didn't diminish the Gregg's dedication to customer service. Hine took the store's TV “tube caddy” home with him in case he had to personally make a house call to fix a tube.

Fanny's son, Gerald Throgmartin, joined the company after 10 years of sales experience at Sears. Her other son, Don, came aboard in 1969, and two years later went to manage the firm's second store in Kokomo, Indiana, for 10 years. Also in 1971, the Gregg's opened their third store, on the south side of Indianapolis.

Hine died in 1974, the same year a fourth location opened in Anderson, Indiana, and Gerald took over day-to-day management of the company. The following year, a fifth h.h. gregg's opened on Indianapolis' east side, just as Hine and Fanny's grandson, Jerry Throgmartin, joined the business [while still a teenager. Fanny continued to work until 1983 before retiring to Florida. She passed in 2004.

In 1989, Gerald Throgmartin became chairman and CEO, while his son Jerry was promoted to president and COO. In 1999, when there were 19 h.h. gregg stores, Jerry became company chairman, CEO and director. A fourth generation of Throgmartins joined the family business when Jerry's son Gregg started work in early 2001. In 2007, the company went public on the New York Stock Exchange.

Thanks to Jerry Throgmartin's leadership and stewardship of Hine and Fanny's devotion to customer service, h.h. gregg's now has 190 locations with stores in 15 states including Georgia, Illinois, Maryland, Pittsburgh, South Carolina and Virginia. Jerry unexpectedly passed away in January 2012 at the age of 57.



In Hwoi Koo (1907 – 1969)
Founder, LG

Getting into business with friends and family – especially in-laws – often proves to be a trying experience, if it succeeds at all. But In Hwoi Koo, founding chairman of LG, believed in “harmony among people.” At the time of the company’s founding, LG was run by several families and organized by close acquaintances, including in-laws. Koo’s harmonious business philosophy promoted consensus-based decision-making and support and full compliance once a decision was made.

Koo’s “noiseless” business management turned LG Corp. into a \$120-billion global conglomerate comprising 60 different companies including chemicals, telecommunications and, of course, its flagship company, LG Electronics, whose roots go back to Korea’s first consumer electronics firm.

Widely considered the father of Korea’s electronics industry, Koo was born on August 27, 1907 in Jisu-myun, South Gyeongsang Province. Raised in a traditional noble family emphasizing Confucian values, he studied the Chinese classics

during his childhood. When he turned 14, he married Eul Su Huh from Gimhae. After graduating from Jisu Elementary School, he went to Jungang High School in Seoul. In 1931, he returned to his hometown and, capitalizing on his experience in running a co-op, he opened his own draper called Koo In Hwoi Store in Jinju and began his career as an entrepreneur.

Shortly after national liberation from Japanese rule after World War II, Koo relocated the base of his business to Busan. He began selling cosmetics, but also decided to produce a cosmetic cream himself and established Lak Hui – pronounced “lucky” in January 1947, the first half of what would become LG.

The success of Lucky Cream cleared the way for LG to become the first Korean company to enter into the plastics industry. Koo marketed various plastic household products, including combs, toothbrushes and dishware. He also developed and produced quality Korean toothpaste that replaced U.S.-made Colgate as the top seller in Korea.

While growing the plastics business and seeking another business, Koo established GoldStar Co. Ltd. in 1958, the first Korean electronics company.

A year later, GoldStar produced Korea’s first home-grown consumer electronics product, the A-501 dual-band (medium and shortwave) tabletop radio. This led to a streak of “Korea’s first” products, including telephones, fans, refrigerators, television sets, washing machines, and others, which brought tremendous change to the lifestyle of the Korean people and accelerated Korea’s rise as a global player in electronics and IT.

Lak Hui, which produced household products under the Lucky brand name, and GoldStar Electronics merged in 1995 to establish the modern incarnation of LG.

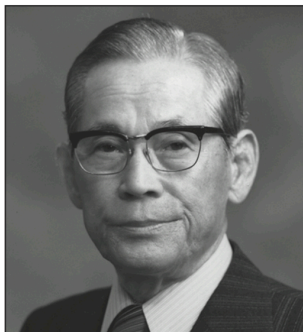
Koo went on to found a number of companies in the chemical and electronics industries, such as a cable company in 1962, which manufactured cables for electricity and telecommunications. Koo’s companies also played an important role in building the much-needed infrastructure in Korea including telecommunications by founding a company that produced switchboards and public telephones.

Koo established LG’s first overseas branch in New York in 1968, the same year it manufactured Korea’s first air conditioner.

For the company, Koo’s most important contribution was his business philosophy and management principles – harmony among people, pioneering spirit and R&D leadership – which are upheld to this day. Koo also called on his employees to become pioneers. He believed R&D was essential to turn this pioneering spirit into a driver of success, a spirit of innovation that thrives today at LG. He valued engineers and made strenuous efforts to develop new products and new technology.

“Find something that others did not try yet,” Koo said. “Begin with something that is essential to people’s living. Once you begin, continue to move forward. Even if you succeed, do not stop there; challenge yourself to something higher, greater and more difficult.”

In 1968, he built and donated the Yonam Library in Jinju, his hometown. Shortly before his death on December 31, 1969, he established the Yonam Foundation – currently LG Yonam Foundation, a public service corporation which offers systematic professional support in culture and education – and left it as his final gift to Korean society.



Byung-chull Lee (1910 - 1987)
Founder, Samsung

Beginning with the founding of the original Samsung Trading Company in 1938, Byung-chull Lee played a vital role in building South Korea's industrial landscape. Over the course of 50 years, Lee established and operated more than 30 companies in industries ranging from import businesses to high tech manufacturing.

Lee's business philosophy focused on the "Economic Contribution to the Nation," giving "Priority to Human Resources" and a commitment to what he called the "Pursuit of Rationality." Lee founded and managed the companies under this philosophy and cultivated them to the best of his ability. Today, he is remembered as South Korea's leading pioneer in business, having also made great contributions to the development of society through various cultural, art, and educational ventures.

Lee was born in Uiryeong-gun, Kyongsangnam-do, Korea on Feb. 12 1910, as the youngest of four children. In 1930, Lee went to Japan to study economics at Waseda University. Upon returning from Japan, he decided to devote himself to running a business

under the belief that building the economy of Korea was his most urgent task. In March 1938, Lee founded the Samsung Trading Company to carry out his philosophy of making an economic contribution to the nation.

Following the success of the Samsung Trading Company, Lee acquired the Chosun Brewery and by the early 1950s, had expanded his enterprise to include sugar, wool, and paper manufacturing that served as the cornerstone for Korea's import/export industry. He also made a significant contribution to developing the nation's financial industry by establishing insurance and banking businesses. Lee and his businesses played a singularly important role in rebuilding the national economy in the aftermath of World War II and the Korean War. In the 1960s, Lee was at the forefront of modernizing the national economy with the introduction of businesses including electronics, retail, clothing, textile, media and land development. As part of his efforts to enhance South Korea's self-sufficiency in agriculture and food production Lee, in 1967, founded Korea Fertilizer, which quickly became the world's largest single fertilizer production facility. Through the next two decades, the enterprise grew to make contributions to high technology industries including semiconductor, defense, aviation, fine chemicals and computers.

Lee opened a new frontier for the media in Korea by establishing a network of a newspaper, a TV broadcasting company and publishing, marking an important milestone in the development of Korea's media culture. His Ho-Am Art Museum helped to cultivate pride in Korea's cultural heritage among all generations and with the Samsung Foundation of Culture, he promoted a culture of learning and advanced the arts.

Lee's foresight that the future of his business relied on the electronics industry led him to found Samsung Electronics in 1969. By April of 1973, Samsung Electronics had developed a 19-inch black-and-white television. Following the success of

this television, the company expanded into other electronics products such as refrigerators and washing machines. In May 1978, the company expanded its television production lines and by 1981, it had manufactured more than 10 million black-and-white televisions.

Samsung Electronics expanded into the semiconductor business in 1974 by acquiring Korea Semiconductor and entered the telecommunications business by acquiring Korea Telecommunications in 1980. In February 1983, Lee made what has come to be known as the "Tokyo Declaration," announcing that Samsung Electronics would enter the DRAM (dynamic random access memory) business. A year later, it became just the third company in the world to develop 64K DRAM chips. In October 1984, it introduced the world's first 256K DRAM and later started mass production of 1 Mega DRAM, helping South Korea become a semiconductor powerhouse and setting the groundwork for the company to be a global technology leader. Today, Samsung is the world's largest electronics company by sales and leads the global TV, mobile phone, memory and LCD (liquid crystal display) markets.

Lee was one of Korea's most highly-regarded businessmen. His pen name, Ho-Am, means "filling up a space with clear water as lakes do, and being unshakeable as a large rock," in reference to his strength and dedication as a businessman.

After his death on November 19, 1987, Lee was awarded the Korean Order of Civil Merit, Mugunghwa Medal by the Korean government and the First Class Order of the Sacred Treasure by the Japanese government. In honoring his father, Samsung Electronics Chairman Kun-hee Lee established The Ho-Am Prize. Since 1991, Koreans who have made distinguished accomplishments in the fields of science, engineering, medicine, arts, and community service have been awarded Ho-Am Prizes annually. Each laureate receives prize money of 300 million won and a seven-ounce gold medal engraved with an image of Byung-chull Lee.



George Elwood Smith (1930 -)

Co-inventor, CCD Imaging Chip

Like he did almost every day, Dr. George E. Smith wandered into the office of his boss, Willard Boyle, at Bell Labs in Murray Hill, N.J., on Sept. 8, 1969, for their usual brainstorming session. Less than an hour later, they emerged with the single most important invention in the history of photography – the charged-couple device (CCD), the imaging sensor chip which ignited the digital camera revolution.

This was not what they intended to create at all.

Smith was born in White Plains, N.Y., on May 10, 1930. Smith's parents could not afford to send him to college, so upon graduating from high school, he enlisted in the Navy. After attending aerograph school – Navy speak for meteorology – he was assigned to the Navy Hurricane Weather Central in Miami. The Navy was slated to kill a research project aimed at finding the location of hurricanes using seismographs to measure the vibrations made in the ocean floor. Smith designed a different seismographic method and saved the project.

Smith also took courses at the University of Miami. He worked part-time jobs at the university, running an ancient mechanical differential analyzer and making basic measurements on semiconductors.

Back from the Navy, Smith entered the University of Pennsylvania as a sophomore, earning his B.A. in physics in 1955. He moved west and earned his Master's (1956) and his Ph.D. (1959) in physics from the University of Chicago, submitting one of the shortest doctoral thesis on record – just three pages on “The Anomalous Skin Effect in Bismuth.”

Following graduation, Smith joined Bell Laboratories, where researchers were given the latitude to work on what interested them. In 1964, he became head of the Device Concepts Department, a group formed to devise next-generation solid state devices.

On that fall afternoon in 1969, Smith and his boss convened to brainstorm about semiconductor integrated circuits. Their boss asked them to examine whether it was possible to devise a form of bubble memory using semiconductors.

Smith had been involved with an effort to create an electron beam imaging tube for the Picturephone, with a target consisting of an array of silicon diodes. After jotting some notes on the blackboard, Smith realized what they were devising could store data, and would also be an image sensor. The CCD takes advantage of the solid state equivalent of the photoelectric effect that won Albert Einstein his lone Nobel Prize in 1921.

According to Smith, “metal-oxide-silicon (MOS) capacitors were already being extensively studied as the gate structure for MOS transistors, which form the basis of today's vast integrated circuit technology. Charge stored on these capacitors could represent digital information for memory – no charge for a zero

and maximum charge for a one – devices or analog information formed by incident light and the solid state equivalent of the photoelectric effect, the amount of charge being proportional to the light intensity.”

The first model based on their idea was constructed and successfully demonstrated a few weeks later. The device was publicly announced early in 1970, and was quickly picked up by several companies including RCA, Fairchild and Texas Instruments. Bell Labs also developed and demonstrated a CCD camera for Picturephone but the effort was terminated when AT&T decided not to develop a Picturephone network.

A researcher at Kodak, CE Hall of Famer Steve Sasson, procured CCD chips from Fairchild and, in December 1975, built the first working digital camera. But before the CCD was used in the first consumer digital cameras in 1994, it was installed in the Hubble Telescope in 1990 to snap digital photos of distant galaxies.

Smith has been a member of Pi Mu Epsilon, Phi Beta Kappa and Sigma Xi, was made a fellow of the Institute of Electrical and Electronic Engineers, fellow of the American Physical Society and a member of the National Academy of Engineering. He holds 31 U.S. patents and is the author of more than 40 papers. Since 1970, Boyle and Smith have received several awards for their accomplishment and, in 2009, they were awarded the Nobel Prize for physics for the invention of the CCD.

Smith retired from Bell Laboratories as head of the VLSI Device Department in April 1986. He then started a world cruise aboard his 9.5-meter sailboat, APOGEE, which he completed in 2003 after 55,000 miles of ocean sailing. He lives in Barnegat, N.J.

A LOOK AT CE INNOVATION

CE
Consumer Electronics
Hall of Fame

Innovation is a hallmark of the consumer electronics (CE) industry. The CE Hall of Fame program honors the innovative pioneers and leaders who contribute to the technologies, products and services that continue to improve our lives. To see the latest advances, attend the world's most important technology tradeshow, the 2013 International CES, January 8-11, where more than 3,000 exhibitors will showcase their products and services.

To show how far we have come, take a look at some of the most remarkable technology developments in recent years, many that were unveiled at CES. Check out the timeline below to see some of these significant milestones.

2012

- U.S. factory sales of consumer electronics exceed \$200 billion annually, worldwide sales top \$1 trillion for the first time.
- The 2012 International CES breaks records – it is the largest show ever with 153,000 attendees and 3,100 exhibitors.
- Kodak files for Chapter 11 bankruptcy and ends camera sales.
- First Wi-Fi-equipped camcorders available.
- AT&T inaugurates 4G LTE network.
- First HDTV with a built-in Web cam goes on sale.
- First ultra HD 4K2K camcorder goes on sale.
- Sprint launches 4G LTE networks.
- AT&T and T-Mobile end merger deal.
- Wi-Fi 802.11ac standard, offering wireless speeds of 1 Gbps, announced.
- Sony PlayStation Vita portable game player goes on sale.
- Nintendo's tablet-controlled Wii U video game console goes on sale.
- Sony purchases Sony Ericsson and re-enters the cell phone market.
- FCC approves super Wi-Fi.
- London Summer Olympics are the first to be broadcast in 3D.
- OLED HDTVs go on sale.
- Wi-Fi Certified Passpoint (Hotspot 2.0) hotspots roll out.
- Mobile Content Venture (MCV) DTV "Dyle" platform, Mobile 500 Alliance broadcast groups initiate Mobile DTV broadcasting.
- First cars with built-in wireless charging pads introduced.

2011

- Apple Co-founder Steve Jobs dies; Apple becomes the world's most valuable company and the first CE business to achieve this status.
- First passive 3DHD TVs go on sale.
- First 4G tablets go on sale.
- Full 3DHD glasses and universal active 3D HDTV glasses standard agreed upon.
- Numerous cell phone carriers end unlimited data plans.
- Microsoft enters into a strategic relationship with Nokia for Windows Phone models.
- Intel announces Ultrabook laptop PC specifications.
- Japanese earthquake and tsunami and flooding in Thailand slow component production.

- Apple expands iPhone sales to Verizon and Sprint.
- Amazon's Kindle Fire tablet/e-book goes on sale.
- First 21:9 aspect ratio HDTVs go on sale; CEA announces 21:9 standards effort.
- Microsoft ends sales of Zune MP3 players.
- Amazon, Apple launch cloud-based content services.
- AT&T and T-Mobile merger announced then disallowed. First tablet PCs running Android 3.0 Honeycomb OS go on sale.
- Apple iPad 2 goes on sale, becomes fastest-selling product of all time.
- Android becomes leading smartphone operating system.
- USA Today's Super Bowl coverage includes two augmented reality experiences.
- First tablet PCs running Android 3.0 Honeycomb OS go on sale.
- 3net dedicated 3DHD channel begins broadcasting; ESPN 3D channel expands to 24-hour schedule.
- First cell phones with near field communications (NFC) go on sale.
- Sprint ends separate iDEN push-to-talk network, merges it with CDMA.
- Movies sold on microSD cards for Android phones, tablet PCs available.
- Amazon e-books surpass paperback book sales.
- Thunderbolt interconnection standard introduced in Apple MacPro laptops.
- First 3D camcorders go on sale.
- Sony launches music streaming service.
- CEA launches wireless power technical standards program, the Wireless Power Subcommittee; first products with Wireless Power Consortium's Qi standard go on sale.
- Qualcomm FLO mobile TV service ends; spectrum sold to AT&T.
- First contextual ecommerce capability, allowing consumers to buy from TV EPG, announced.
- First Mobile DTV laptop dongle antennas go on sale.
- Motorola splits into two companies; cell phone business sold to Google.
- Glasses-free 3D HDTVs demonstrated.
- First universal active shutter 3D glasses available.
- Cisco announces that it will end sales of Flip pocketcam camcorder.
- Audiovox buys Klipsch.
- First dual-core processor smartphone, Motorola's Atrix, goes on sale.
- Retailer Ultimate Electronics goes out of business.
- First dual-screen smartphone announced.
- Verizon and Panasonic demonstrate 3D HD streaming.
- Nintendo 3DS, the first glasses-free 3D portable gaming device, goes on sale.
- First LTE 4G cell phones available.
- Guinness World Records names Microsoft Kinect the fastest-selling consumer electronics device ever.

2010

- Smartphones pass PCs in sales.
- CES opens doors to consumers

- Sharp develops 3D camera for mobile phones.
- Skype HDTV-based video telephony introduced.
- 4G LTE wireless broadband networks rolled out in more than two dozen markets.
- Apple iPad goes on sale.
- HDMI specification v1.4 adopted and first v1.4-enabled devices go on sale.
- 2K and 4K "ultra" HDTVs demonstrated.
- First USB 3.0 products go on sale.
- Google connected TV STB announced.
- Gesture-based gaming systems from Microsoft and Sony, Kinect and Move, go on sale.
- Wireless power transmission successfully demonstrated.
- First color dedicated e-readers go on sale.
- 3D upgrade for legacy HDMI v1.3 devices is announced.
- First 3D HDTVs, 3D Blu-ray players and 3D Blu-ray movies go on sale; first stereoscopic 3D programs broadcast.
- TerreStar initiates consumer satellite cellular smartphone service.
- HP buys Palm.
- Microsoft releases "Kinect" motion-control accessory.
- First "passive" 3D HDTVs go on sale.
- High-speed CompactFlash card standard specification announced.
- Cisco debuts UMI home video conferencing.
- Sony unveils first interchangeable lens camcorder.
- West Coast CE retailer Ken Crane's closes.
- First HSPA+ 4G cell phone announced.
- First 3D digital cameras available.
- First cell phones with built-in mobile Wi-Fi hot spot capability available.
- Flash memory becomes predominant camcorder storage medium.
- Sonic purchases DivX.
- First smartphones running Microsoft's Windows Phone 7 OS go on sale.
- Mobile DTV broadcasting begins.

2009

- Analog TV broadcasting ends on June 12, 2009.
- Mobile DTV standard established and first products go on sale.
- Video Bluetooth standard announced.
- SDXC (Secure Digital eXtended Capacity) format, enabling SD cards of up to 2 TB, announced.
- Microsoft opens retail outlets.
- Panasonic and Sanyo merge.
- JVC and Kenwood merge.
- Micro Four Thirds digital cameras go on sale.
- Pioneer sells its TV business to Panasonic.
- MicroUSB universal cell phone charger standard proposed.
- EPA Energy Star v3.0 standards for lower energy LCD HDTVs announced.
- First touchscreen desktop PC monitors introduced.
- E-magazine/newspaper format, Skiff, announced.
- 500 GB DVD-sized optical disc demonstrated.

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- First movies on USB thumb drives available.
- iTunes shifts to DRM-free tracks.
- 802.11n Wi-Fi standard is ratified.
- First 3D still camera, Fuji W1, goes on sale.
- First solar powered cell phone announced.
- Portable HD Radio receivers become available.
- In-home wireless HDMI video connectivity standards WiHD and WHDI announced.
- Blu-ray group ratifies 3D Blu-ray standard.
- Bluetooth v3.0 specification announced.
- First call made via hybrid cell/satellite phone.
- Circuit City ends operations.

2008

- First “green” CES.
- Digital TV converter coupon program begins and converter boxes go on sale.
- HDTVs with Web access become widely available.
- First cell phone running Google’s Android operating system, the G1, goes on sale.
- High-definition movie rental downloads begin.
- First two-way personal navigation device (PND) goes on sale.
- OLED HDTVs unveiled.
- First cell phone with near field communications technology available.
- 4G LTE (Long Term Evolution) wireless broadband network standard ratified.
- Pico pocket video projectors go on sale.
- First ultra-thin LCD HDTVs go on sale.
- Mobile DTV standards and testing announced.
- First Blu-ray players with streaming movie services included announced.
- In-room cable-replacement WirelessHD (WiHD) technology finalized.
- First Tru2way interactive cable TV STBs and HDTVs become available.
- Blu-ray becomes dominant high-definition DVD format.
- Roll-out of nationwide WiMAX mobile wireless broadband network begins.
- First ultra-light notebook laptop PCs go on sale.
- Most online music retailers end copy protection and restrictions.
- First Blu-ray discs with extra PC-compatible digital copies included go on sale.
- Sirius and XM satellite radio providers merge.
- First touchscreen laptop PCs announced.

2007

- CES celebrates 40th anniversary.
- First cell phones capable of receiving broadcast television available.
- Inkless printing – no ribbons or cartridges – demonstrated.
- Amazon Kindle e-book reader introduced.
- Windows “Vista” operating system released.

- Apple iPhone introduced.
- Portable navigation devices (PND) become mainstream category.
- “Media streamer” Wi-Fi STBs to access local PC-based AV content on an HDTV become available.

2006

- Nintendo Wii and Sony Playstation 3 video game systems go on sale.
- Microsoft Zune digital music player introduced.
- The first consumer high-definition DVD players go on sale in the U.S.
- The first videogame systems with high-definition DVD players hit the market.
- The first OCAP (Open Cable Applications Platform) cable systems begin operation and first OCAP-enabled TVs are available.
- President Bush signs legislation to end analog television broadcasting on February 17, 2009.
- Hybrid format, chip sets for combining Blu-ray/HD-DVD high-definition DVD announced.
- First broadband HSDPA GSM cell phones available in U.S.
- One billionth Bluetooth device ships.
- The first 1080p plasma HDTVs go on sale.
- CEA and IT industries file “consensus proposal” with FCC to end plug-and-play two-way cable TV interoperability stalemate.
- First RPTV HDTVs with LED lighting technology begin shipping.
- The first flash memory, DVD and hard disc drive-based high-definition camcorders using AVCHD format hit the market.
- Inkjet printers using long-lasting pigment-based ink available for first time.
- Sales of digital TVs surpass sales of analog TVs for the first time.
- First DECT 6.0 cordless phones go on sale.
- First dual cellular/Wi-Fi, cordless/Wi-Fi phones available.
- New Wi-Fi 802.11n specification, enabling throughput of 100 Mbps for wireless local transmission of HDTV, is approved by IEEE.
- First high-capacity – 4 GB-plus – flash memory cards available.

2005

- The first digital camera with built-in Wi-Fi capability available.
- The first subscription-based online digital music services and compatible portable devices available.
- The first hard disk drive-based camcorders go on sale.
- Microsoft’s Xbox 360 video game system goes on sale.
- FCC requires mandatory inclusion of ATSC HDTV tuner in 50 percent of all 24-inch to 35-inch HDTVs by July 1.
- CEA inducts its first class of Digital Patriots, honoring government and industry leaders for their positive impact on the rapidly evolving consumer technology industry.
- The first PCs with dual processors become available.
- Cell phone carriers offer live and downloadable TV clips and online downloadable music stores.

- The first stand-alone VoIP phones are introduced.
- Consumer digital cameras reach 10-megapixel resolution.
- AV home theater receivers with HDMI connectivity and direct satellite radio connectivity go on sale.
- The first portable MP3 player/satellite radio recorders are announced.
- Flash media card capacity reaches 4 GB.
- The first single-use digital camcorder goes on sale.
- U.S. Court of Appeals strikes down FCC’s “broadcast flag” order.
- The first HDTV with built-in HD-DVR goes on sale.

2004

- The first U.S. 3G cellular network services and phones are announced.
- Single-year U.S. sales of consumer electronics surpass \$100 billion.
- Combination cable HDTV STB and HDTV DVRs and CableCARD-equipped DTVs go on sale.
- The first flash memory camcorders go on sale.
- Discussions begin on inter-carrier push-to-talk cellular compatibility.
- Dual-layer (8.5 GB) DVD recorders and media are announced.
- The first city-wide Wi-Fi networks are activated.
- Cell phones equipped with video cameras and megapixel digital still cameras become available.
- The first cell phones capable of receiving live TV broadcasts become available.
- The first portable HDTV recorder, using MiniDV tape-based HDTV recording format, is announced.
- FCC and FTC begin rules-making process to curb wireless spam.
- 1 GB flash memory cards are available; new FISH (flash internal semiconductor hard drive) flash memory format is announced.
- The first 5.8-GHz cordless phones go on sale.
- The first hard disk drive-based portable AV players go on sale.
- Professional Audio/Video Retailers Association (PARA) merges with CEA.
- DualDisc, combination CD and DVD, introduced.
- The first portable digital music players with color LCD screens go on sale.
- UWB (ultra wideband) wireless broadband technology capable of speeds as high as 110 mbps is commercialized.
- More than 200 companies form DLNA (Digital Living Network Alliance) to merge multiple wired and wireless, CE and PC standards into interoperable home network standards.
- USB-equipped flash memory thumb drives go on sale.
- GPS Wide Area Augmentation System (WAAS) is implemented, improving accuracy to within a yard.

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